Sub-seasonal wind variability and El Niño

by

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Abstract

Sub-seasonal wind variability and El Niño

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The role of sub-seasonal western and central Pacific surface zonal wind variability in the evolution of El Niño sea surface temperature anomaly (SSTA) is examined. The surface wind structure and atmospheric convection variability of tropical Pacific westerly wind events (WWEs) is described. The average tropical Pacific SSTA variability following and in the absence of equatorial WWEs is examined over the period 1986-1998. The surface wind structure of the Madden-Julian Oscillation is examined (MJO), along with relationships between the MJO and WWEs. The response of an ocean general circulation model (OGCM) to composite MJO and WWE surface wind stress forcing is explored.

WWEs can be classified into eight types based on the location of the maximum zonal wind anomalies. WWEs are found to be compact in space and time, exhibiting little translation during their lifetime. Typical scales for WWEs are derived over the period 1986-1995. It is found that certain WWE types exhibit significant seasonality, and some have a significant correlation with the Troup Southern Oscillation Index.

In the absence of equatorial WWEs, tropical Pacific SSTA tends to remain at or return towards climatology. Following equatorial WWEs, tropical Pacific SSTA warms towards or remains at El Niño type conditions.

WWEs are significantly associated with atmospheric convection. The MJO surface wind stress anomaly fields exhibit two regimes in the equatorial Pacific. In the western equatorial Pacific there are both easterly and westerly anomalies with the westerlies dominating, in the central and eastern equatorial Pacific the main anomalies are easterlies. The WWEs which occur during the MJO are modulated by the convective variability of the MJO. West-of-dateline WWEs exhibit a strong relationship to tropical cyclone activity.

Following a composite MJO, the tropical Pacific SSTA in the OGCM does not tend to warm; the composite MJO does not provide a simple mechanism for El Niño waveguide warming. Idealized WWEs drove tropical Pacific SSTA warming in the OGCM; enhanced WWE activity provides a mechanism for the onset of El Niño.